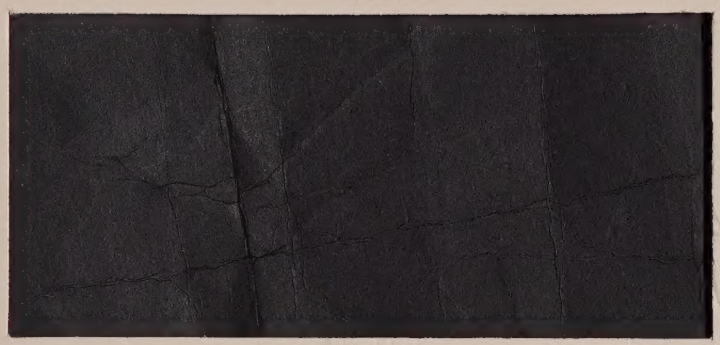
Dept. 3730 Incoming Inspection

CALIBRATED
SFSD
Date 8-22-85
Due 4mo
Rev
By EML 31

EML
SFSD



MODEL 811/811A
DIGITAL GAUSSMETER
INSTRUCTION AND SERVICE
MANUAL

Subsidiary,
Magnetics & Electronics, Inc.

BELL INC.
6120 Hanging Moss Road
Orlando, Florida 32807
Phone: 305-678-6900
TWX: 810-853-3115

UN-01-049

TABLE OF CONTENTS

1.0 Operating Instructions (Model 811 Digital Gaussmeter)

2.0 Instructions and Service Manual (Model 8860 Field Detector Module)

3.0 Instruction and Service Manual (Model 8510 Bench Cabinet)

4.0 Warranty

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_10732

OPERATING INSTRUCTIONS

MODEL 811 DIGITAL GAUSSMETER

GENERAL:

The Model 811 Digital Gaussmeter is a very high stability and accurate magnetic field measuring instrument. Direct digital readout in gauss or kilogauss (as indicated by range switch position) is provided. Ranges cover from 100 Gauss to 100K Gauss in decade steps (red scale) using F. W. Bell, Inc. high stability probes. These probes have a red handle and are marked as 10X probes. Ten times greater sensitivity is possible (black scale) with blue handle probes marked 1X. Instrument stability at output jacks is better than 0.01% per ^{o}C with long term internal calibration accuracy of 0.1%. The readout unit accuracy is 0.05% of reading $\pm$ one count.

OPERATION:

1. Connect the line cord to a source of ac power 50-60 Hz. 115 or 230 volts may be used by switching the selector on the rear of the cabinet.

2. The probe is connected to the probe socket on the front panel. Make sure the clamp ring is securely tightened.

3. Linear readout is provided at both the panel meter and the output jacks. The standard output ranges from -1 to 0 to +1 volt for full scale gauss as selected by the range switch. Linear output is available to 1.999 times full scale giving essentially 100% overrange capability.

4. With the probe in a magnetic shield or zero gauss chamber, adjust the Zero Controls to obtain a Zero output indicator reading, with the Range Switch at 100 Gauss Full Scale (or 10 Gauss for 1X probe). If the zero controls have no effect, the Zero Control Out Switch may be in the OUT position. Disengage the captive screws on the Field Detector module and slide forward. The Zero Out switch is located on the left side panel. Make sure it is in the IN position for the controls to operate.

5. Switch the Range to INT. CAL position and adjust the CAL controls to obtain the output voltage stamped on the probe serial label. The accuracy of this setting will directly affect the accuracy of the field readings.

6. The instrument is now ready to use.

7. Place the probe in the desired location for the measurements. The Range should be set to the appropriate position and the output indicator will read the field with 1 volt being the Range switch indicated field value, i.e., a 1 volt output on the 1 K range indicates a 1 K Gauss Field.

8. The polarity switch may be used to give a positive output voltage for a given field direction through the probe. The output voltage and readout are bipolar with field direction and therefore indicate the field direction.

OPERATING INSTRUCTIONS
MODEL 811 DIGITAL GAUSSMETER

N O T I C E !

The digital panel meter in this unit requires a 30 minute warm-up period to stabilize.

SPECIFICATIONS

DIGITAL READOUT

(MODELS 8880, 8881, 8882, and 8883)

1. Power Requirements: 105-125VAC, 50-60 Hz.

2. Accuracy: 0.05% of reading ± one count.

3. Input: 1.999 or 1.9999 VDC including overrange.

4. Out of Range Indication: Display blanked or erratic flicker.

5. Operating Temperature: 15° to 35°C (59° to 95°F).

6. Logic Outputs: Standard DTL-TTL Practice.
   NOTE: BCD outputs are available at the rear module connector but are not brought to the outside of the bench cabinet on the Model 811 and 811A digital gaussmeters. The lower back panel on the bench cabinet may be removed for access to the rear module connectors. See the enclosed diagram for the correct pin position.

7. Physical Dimensions: 4 1/8" wide (3 Module widths). 6 5/8" high x 10 3/4" deep (including rear connector) behind front panel.

XI PIN CONNECTIONS

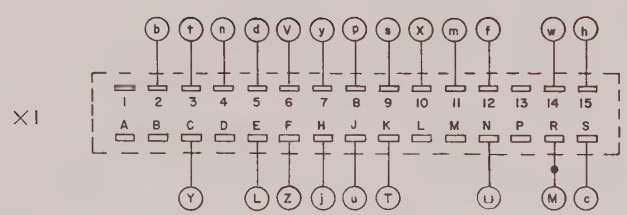
1.	EXTERNAL REF	A.	SIGNAL INPUT 10V, 100V, 1000V
2.	SIGNAL INPUT	B.	SPARE
3.	PRINT COMMAND	C.	OUTRANGE
4.	POLARITY (HIGH=NEG.)	D.	HOLD (Open Collector)
5.	BCD 8	E.	BCD 1
6.	BCD 2	F.	BCD 4
7.	BCD 80	H.	BCD 10
8.	BCD 20	J.	BCD 40
9.	BCD 800	K.	BCD 100
10.	SIGNAL GND	L.	DP 3
11.	BCD 400	M.	DP 2
12.	BCD 200	N.	DIGITAL GND, BCD GND
13.	SPARE	P.	DP 1
14.	BCD 1000	R.	SHIELD
15.	117/234 VAC LINE 1	S.	117/234 VAC LINE 2

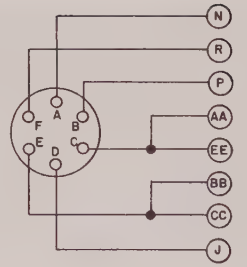
*CAUTION

DO NOT APPLY SIGNALS TO TERMINALS WITHOUT SPECIFIC INSTRUCTIONS.

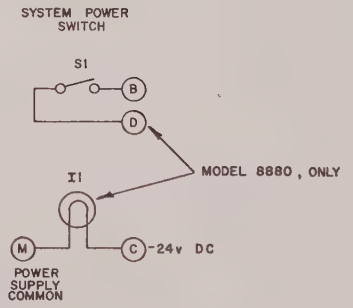
NOTES:

1. CIRCLED LETTERS REFER TO TERMINAL PINS ON REAR CONNECTOR BLOCK.
2. XI IS CONNECTOR ON REAR OF DIGITAL PANEL METER.
3. FOR WIRING HARNESS AND COLOR CODE SEE YD-2482.
4. THE ABOVE TERMINAL DESIGNATIONS APPLY TO A WESTON MODEL 1230 DPM ONLY.
5. DECIMAL POINT IS WIRED INTERNALLY BY THE DPM VENDOR.





PROBE CONNECTIONS TO FIELD DETECTOR (MODEL 8880, ONLY)



SCHEMATIC DIAGRAM
MODEL 8880/8881 DIGITAL READOUT

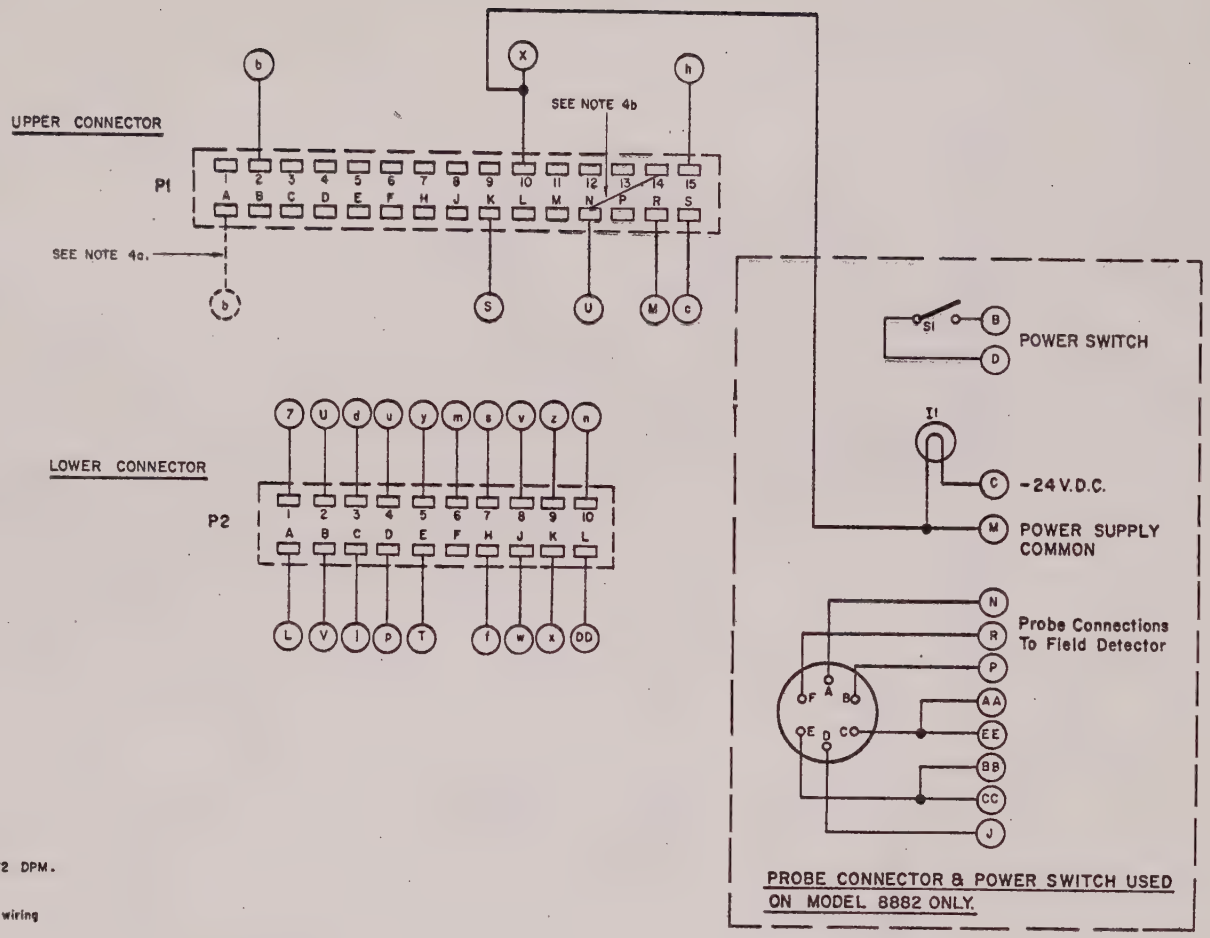
UC-3008

P1 Pin Designations

1	SPARE	A	HIGH INPUT
2	LOW INPUT	B	SPARE
3	SPARE	C	SPARE
4	SPARE	D	SPARE
5	SPARE	E	SPARE
6	SPARE	F	SPARE
7	SPARE	H	SPARE
8	SPARE	J	SPARE
9	SPARE	K	$\overline{\text{HOLD}}$
10	ANALOG GND.	L	OVERRANGE
11	DECIMAL POINT	M	SPARE
12	DECIMAL POINT	N	DIGITAL GND.
13	DECIMAL POINT	P	SPARE
14	DECIMAL POINT	R	EARTH GND.
15	+A.C.	S	-A.C.

P2 Pin Designations

1	BCD 4	A	BCD 1
2	DIGITAL GND.	B	BCD 2
3	BCD 8	C	BCD 10
4	BCD 40	D	BCD 20
5	BCD 80	E	BCD 100
6	BCD 400	F	$\overline{\text{PRINT COMM.}}$
7	BCD 800	H	BCD 200
8	BCD 4,000	J	BCD 1,000
9	BCD 8,000	K	BCD 2,000
10	+POLARITY	L	BCD 10,000



NOTES:

1. The above terminal designations apply to WESTON Model 1234 and 2472 DPM.
2. Circled letters refer to pins in module rear connector block.
3. P1 & P2 are digital panel meter rear connectors.
4. If it is necessary to use a WESTON Model 1294 DPM the following wiring changes must be made.
   a.) Remove GRN wire from P1-2 and relocate GRN wire to P1-A.
   b.) Remove jumper from P1-N to P1-14.

Schematic Dia.- Models 8882 & 8883 Digital Readout.

UC-2946

PARTS LIST MODELS 8880/8881 & 8882/8883

SCHEMATIC REF.	DESCRIPTION	BELL PART NUMBER
S1	Power Switch, Toggle	33830
I1	Pilot Lamp, 28V-.04A, #387	30480
None	Connector, Probe	31730
X1 or P1	Connector, 15/30	32135
P2	Connector, 10/20	32119
None	Meter, 3-1/2 Dig. Weston 1230 or 2462	10181
None	Meter, 4-1/2 Dig. Weston 1234 or 2472	10180

MODEL 8860
FIELD DETECTOR MODULE

INSTRUCTION AND SERVICE MANUAL

Subsidiary,
Magnetics & Electronics, Inc

BELL INC.
6120 Hanging Moss Road
Orlando, Florida 32807
Phone: 305-678-6900
TWX: 810-853-3115

UN-01-036

CONTENTS

SECTION I	GENERAL DESCRIPTION	1
	I-1 General	1
SECTION II	SPECIFICATIONS	2
	II-1 Electrical and Performance Specifications	2
	II-2 Physical Specifications, Controls and Connectors	3
SECTION III	INTERCONNECTION	5
	III-1 General	5
	III-2 Connections	5
SECTION IV	OPERATION	7
	IV-1 Probe Zeroing	7
	IV-2 Calibration	8
	IV-3 Operation	8
SECTION V	MAINTENANCE	9
	V-1 Circuit Operation	9
	V-2 Adjustment and Alignment Procedure	9
	V-3 Trouble Shooting	10
	V-4 Block Diagram and Schematic	
SECTION VI	OPTIONS	11
	VI-1 10 Volt Output	11
SECTION VII	PARTS LIST	i

SECTION I

GENERAL DESCRIPTION

I-1 General:

The Model 8860 Field Detector is a precision magnetic field measuring instrument, featuring high stability and repeatability through solid state construction. It has been designed in a modular configuration to mate with the Bench Cabinet Model 8510 and Rack Bin Model 8520. This flexibility allows the Field Detector to be used as a laboratory instrument as well as a component in industrial systems.

A wide range of standard and special probes is available. Factory calibration of probes is with reference to a laboratory standard magnet. The standard is measured by the Nuclear Magnetic Resonance (NMR) technique and provides traceability to the National Bureau of Standards. The user can then set this calibration into the instrument through the internal CAL procedure. When using the high stability 10X (red) Bell probes, the measurement range extends from 100 gauss full scale to 100 K gauss full scale, with full scale output being 1 volt. With 1X (blue) probes, the sensitivity is 10 times greater (10 G full scale to 10 kG full scale). The 8860 can also accommodate up to 100% overranging thus providing a 2 volt output at 2 times full scale. Output is instantaneously proportional to the field in magnitude and polarity from dc to 400 Hz.

SECTION II

SPECIFICATIONS

II-1 ELECTRICAL AND PERFORMANCE SPECIFICATIONS

(a) Measurement Ranges:

1. Using 10X probes (red) the full scale ranges are:

100 G	10 kG
1000 G	100 kG

2. Using 1X probes (blue) the full scale ranges are:

10 G	1000 G
100 G	10 kG

3. Full scale output is 1 volt with linearity extending to 100% overrange or 2 volts.

(b) Calibration:

1. Calibration is with reference to a laboratory standard magnet traceable to NBS.

2. The Internal Calibration Point error does not exceed ±0.1%.

(c) Linearity:

1. Instrument Linearity: ±0.05% of reading, plus ±0.02% of full scale.

2. Probe linearity errors must be added to the above errors to obtain overall measuring linearity.

3. Probe linearity curves may be obtained for most probe types for use in correcting the readings for probe errors.

(d) Stability:

1. Temperature: ±0.01% of reading /°C plus ±0.002% of full scale /°C.

2. Probe temperature effects must be added to the above errors to obtain overall stability.

3. Supply voltage: ±0.01% of reading plus ±0.01% of full scale for a 0.1 volt change in the plus and/or minus supply voltages.

4. Long Term Internal Calibration Point Stability: ±0.05% per year.

(c) Output:

1. One volt full scale with 2 volts overrange maximum without loss of linearity. Load current 5 mA maximum with an internal impedance of 0.1 Ω max. short circuit protected.

2. Noise: -55 dB below full scale over the 400 Hz instrument bandwidth.

3. Frequency Response: The output is instantaneously proportional to the field in magnitude and polarity from dc to 400 Hz. The output is down about 1 dB at 400 Hz.

4. Step Response: The rise time for a full scale step field input is about 1 ms with less than 10% overshoot.

(f) Power Requirements:

Well regulated dc power input of +14.5 to +15.5 volts at 35 mA and -14.5 to -15.5 volts at 55 mA plus 5 mA max. for output load current from the plus or minus supply depending on output polarity.

II-2 PHYSICAL SPECIFICATIONS, CONTROLS AND CONNECTORS

(a) Front Panel Controls:

1. Range Switch: The full scale range (red) is set in decade steps of 100, 1K, 10K and 100K for 10X (red) probes. The full scale range (black) is set in decade steps of 10, 100, 1K, 10K for 1X (blue) probes.

2. Polarity Switch: Selects which field direction through the probe will give a positive output voltage.

3. ZERO Controls: COARSE and FINE controls are provided to balance each individual probe for zero output in the absence of a magnetic field. They will also suppress small residual dc fields up to approximately 20 gauss.

4. CAL Controls: COARSE and FINE controls to calibrate the instrument and probe either to the internal calibration point or to a standard magnet.

5. Output Jacks: The black and red jacks will accept a standard double banana plug with 3/4" spacing. The output voltage is instantaneously proportional to the field with 1 volt being full scale. The black jack is common to the instrument ground.

(b) Rear and Side Panel Connectors and Controls:

1. Connectors: The multipin connector on the rear panel provides for all electrical interconnections to the instrument.

	Pin	Description
V_H	AA, EE	Input from Hall generator
	BB, CC	Input from Hall generator
I_c	J	Control Current to Hall generator
	N	Control Current to Hall generator
Input Power	E	+15 Volt dc input
	H	-15 Volt dc input
	M	dc input common
Output	b	Output
	X	Output common
Jumper to Increase Range	P	Zero Control range adjust
	R	Zero Control range adjust

Check the schematic diagram for more complete details on the internal pin connections.

2. Zero Controls Switch: The zero controls "IN-OUT" switch is on the side of the instrument. This permits disconnecting the zero controls when using special probes which have their own zeroing circuits.

(c) Weight:

Shipping: Approx. 5 pounds

Net: 3-3/4 pounds

(d) Physical Dimensions:

4-1/8" wide (3 module widths) x 6-5/8" high x 10-3/4" deep (including rear connector) behind front panel. Operating controls extend 1" from panel surface.

SECTION III

INTERCONNECTION

III-1 GENERAL

This section describes the method of interconnecting the Model 8860 to its power source, output feed, and field sensing probe. If the Field Detector is part of a system or mounted in a cabinet containing the necessary interconnections, the following instructions may be disregarded.

III-2 CONNECTIONS

(a) Rear Panel Connector:

All input and output connections are made through the rear panel connector. The following connections are available:

1. +15 volt dc power input.
2. -15 volt dc power input.
3. dc power input common.
4. Hall voltage quad input.
5. Zero control range adjustment jumper contacts.
6. Instrument output.
7. Switch points on Range Switch.
8. Hall exciting current output.

(b) Power Connections:

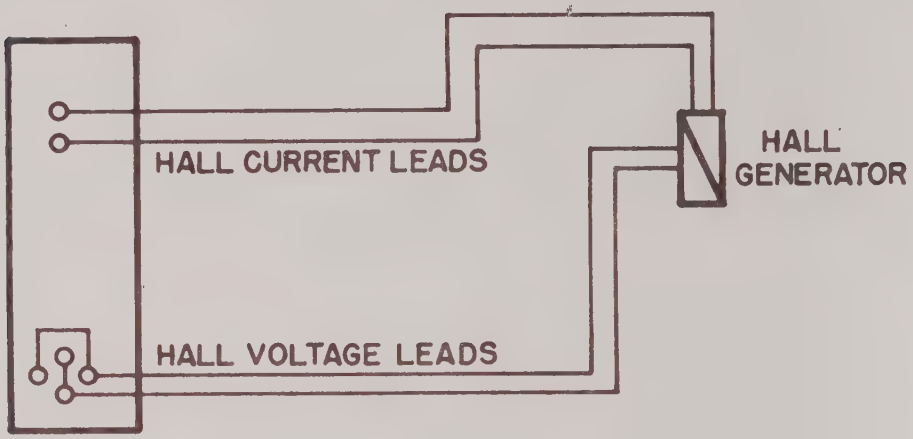
The power connections should be made to pin E for the +15 volts and pin H for the -15 volts. The supply voltage should never exceed 18 volts under any circumstances with normal operation never exceeding 15.5 volts. CAUTION! Reverse polarity of the dc power input may cause damage. Use care when making the connections. The common or ground connection is to pin M. The module chassis is not internally connected to circuit ground to avoid common ground currents in system installations. The chassis must be connected to power supply common if this connection is not otherwise established.

(c) Probe Connections:

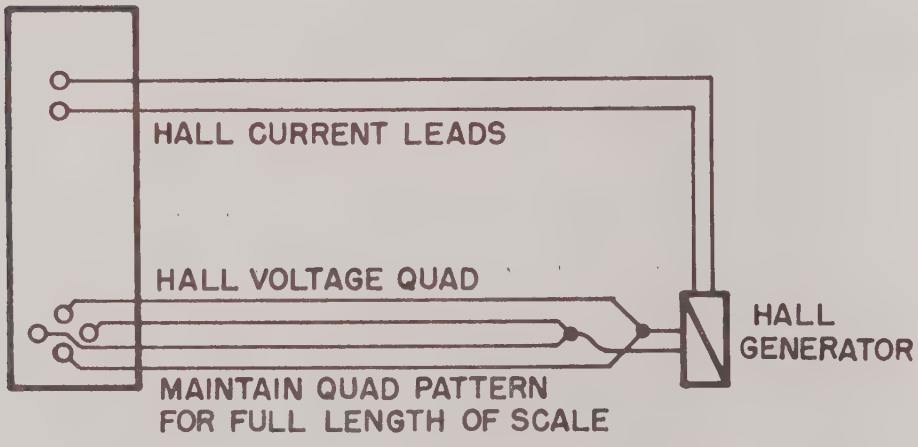
Connection of the Hall probe to the 8860 requires care and should be performed as described below.

The Hall voltage connections are through a quad arrangement at the connector. Because of the very low signal levels, this arrangement is used to reduce stray induced pickup. Shielding will not help because the pickup is inductively coupled rather than capacitively coupled.

The connection arrangements are shown in the diagrams below:



OR PREFERABLY



The quad arrangement may be changed to a pair of leads by jumping pin AA to EE and BB to CC as shown. If a long cable or the special F. W. Bell probe cable is used, maintaining the quad arrangement up to the Hall generator is preferable.

CAUTION: Unless the special F. W. Bell probe cable Part No. WA-1684 is used, separate twisted cables must be used for the current leads and the Hall voltage leads. Excessive coupling between these cables could cause overload on the low ranges, even though the output voltage is less than 2 volts.

(d) Zero Control Range:

Certain probes and Hall generators require a wider range of zero control action. Jumping pin P to pin R will increase the zero controls range by about 12 times.

(e) Instrument Output:

Pins b and X are the instrument output. They are paralleled with the front panel jacks with pin X being the common. The common output pin is internally connected to the common power supply pin M. Care should be exercised in connecting the commons to eliminate the possibility of ground loops and circulating currents.

(f) Range Switch Points:

The range switch has an auxiliary set of contacts to indicate its position. Pin S on the rear connector is the wiper which is connected to pin r on the 100 range; to pin k on the 1000 range; to pin e on the 10K range; to pin a on the 100K range and to pin W on the INT CAL position.

The contacts are rated at 20 volts and 10 mA dc. It is recommended that no power or high frequency signals be impressed on any of these pins as the instrument performance may be affected.

SECTION IV

OPERATION

IV-1 PROBE ZEROING

The probe residual output is reduced to zero with the probe zeroing controls. If the probe has a control box containing zero controls, the switch on the left side of the Field Detector Module 8860 must be switched "OUT". Otherwise the switch should be set to the "IN" position. The range switch should be set to the 100G position when adjusting zero controls. The probe should be placed in a location of zero magnetic field for the zero adjustment. A zero gauss chamber Bell Part No. YA-111 slipped over the end of the probe is recommended. The zero controls are adjusted until a zero output voltage is obtained at the output jacks. The accuracy of this setting will affect the reading accuracy; therefore a highly sensitive output meter should be used. If the probe is zeroed in the presence of a residual magnetic field, that field measurement will be zeroed out. The instrument will then measure the field changes or additional field from that point.

IV-2 CALIBRATION

(a) Calibration Against the Internal CAL Signal:

It is always recommended that calibration against the internal CAL point be used in place of a standard magnet, as it will give better absolute accuracy than any presently available standard magnet. To calibrate against the internal CAL point, set the range switch to the INT CAL position. Adjust the Coarse and Fine CAL controls to obtain an output voltage at the jacks, which is equal to the "CAL Constant Voltage" printed on the Probe Model Label. This voltage can range between 0.5700 and 1.1400. The calibration accuracy is directly related to the accuracy of this voltage measurement. Therefore, a high quality output indicator such as a 4-place Digital Voltmeter should be used to obtain best calibration.

(b) Calibration Against a Standard Magnet:

For this calibration the probe should be carefully zeroed in a zero field environment. The probe is then placed in the Calibrating Magnet field and the Range switch set to the appropriate measuring range. The CAL controls are then adjusted until the output voltage indicates the magnitude of the calibrating field. For example: if the calibration field is 510 gauss, the Range switch would be set to 1000 and the CAL controls would be adjusted to give an output voltage of 0.510 volts. The errors in this calibration would then be the accuracy of the Calibrating Magnet field plus the Model 8860 and probe linearities.

IV-3 OPERATION

Once the Zero and Calibration adjustments have been made, the Model 8860 is ready to use. The probe is placed in the proper position for the field measurement. The probe is direction sensitive and hence the output indicates the magnitude of the field component in the sensitive direction. The probe should be oriented to pick up the preferred field component. If the output voltage is not of the desired polarity, the Polarity switch may be changed to reverse the output.

The output voltage indicates the field magnitude with 1 volt being the full scale range in use. For example: if the output voltage is 0.7532 and the Range switch is set to the 10K range, the field magnitude in the sensitive direction is 7.532 kilogauss. If the output were 1.543 V, the field would be 15.43 kilogauss. The instrument is linear up to 2 volts output. Therefore fields up to 20 kilogauss can be measured on the 10K range and up to 200 kG on the 100K range. The accuracy of the measurement will be within the accuracies stated in the Specifications (Sect. II) if the instrument was carefully zeroed and calibrated.

The range over which measurements may be taken depends on the probe as well as the instrument. Certain Hall generators are optimized to work over certain field ranges. Accurate measurements will be

achieved only up to the maximum field rating of the probe. Check the probe specification for this information. Linearity curves are supplied for high accuracy probes and may be obtained on many others. This curve shows the probe error from true reading. By adding the amount by which the probe output is down, to (or subtracting the amount by which the probe output is up, from) the field measurement, the readings may be corrected for probe linearity errors.

SECTION V

MAINTENANCE

V-1 CIRCUIT OPERATION

The Hall generator is supplied with an excitation current, I_c, from the 5 kHz oscillator and current regulated amplifier. The Hall output voltage, V_H (the flux modulated carrier signal), is connected to the input summing circuit. At this point, the zeroing voltage from the zero controls is subtracted from the Hall generator output. The difference is amplified depending on the range in use to produce the proper output. The amplifier output feeds the synchronous demodulator which converts the amplified flux modulated carrier into a flux proportional output voltage. This voltage then feeds a low-pass filter circuit which removes the residual carrier components and other noise components above the 400 Hz instrument bandwidth. The filtered output is then made available at the front panel jacks and rear connector block. AC fields up to 400 Hz may be measured by connecting ac readout equipment to the output.

V-2 ADJUSTMENT AND ALIGNMENT PROCEDURE

IMPORTANT - None of the adjustments described in this section should be disturbed unless the instrument is malfunctioning and tests indicate adjustment is necessary.

(a) I_c Adjustment R163:

This potentiometer adjusts the control current (I_c) and thus sets the effective gain of the instrument. It is adjusted to provide 1.150 V ±10 mV dc at the output jacks with the Range switch set to INT CAL and the Coarse and Fine CAL controls set to maximum clockwise position. User adjustment of R163 is not normally required.

(b) Offset Adjustment R211:

This potentiometer is used to zero the output amplifier/filter offset voltage. Adjustment of this control may be required if the power

supply input voltage is somewhat different from its value when R211 was initially adjusted. Proper adjustment of this control may be determined as follows:

1. Allow the Field Detector and power supply to reach normal operating temperature. At least 30 minutes warm-up is recommended.

2. Zero the probe as described in Section IV-1.

3. Set the range switch to the 100 kG position.

4. Check the output voltage appearing at the output jacks. If the output exceeds approximately 0.3 mV dc and does not reverse polarity with the 8860 polarity switch, R211 should be adjusted to obtain zero output.

V-3 TROUBLE SHOOTING

The following suggestions and procedures are recommended when difficulty is encountered in operating the instrument:

(a) Make certain that a reliable electrical connection exists between the Field Detector chassis and system power supply common.

(b) The probe should be checked whenever erratic operation is obtained, particularly at low levels. A fractured probe element will produce unstable and erratic operation, and the zero adjustment on low ranges will become particularly unstable. Check the cable also for poor contact or wire breakage. Light finger pressure against the probe element should produce only small temporary effect.

(c) Refer to the circuit diagrams and to the parts list, by using schematic reference symbols, to obtain detailed information on parts used.

(d) It is important to replace parts with the same type and electrical value as originally used. Parts having F. W. Bell, Inc. part numbers include those designed especially for the Model 8860 and those not readily available from normal repair parts outlets. These may be obtained directly from the factory.

(e) Use particular care in replacing diodes, transistors, and integrated circuits; do not apply excessive heat to the leads. A heat sink is recommended, such as gripping with pliers on the lead between the body of the component and the soldering iron.

(f) If necessary to return this instrument to the factory for repair, refer to WARRANTY section.

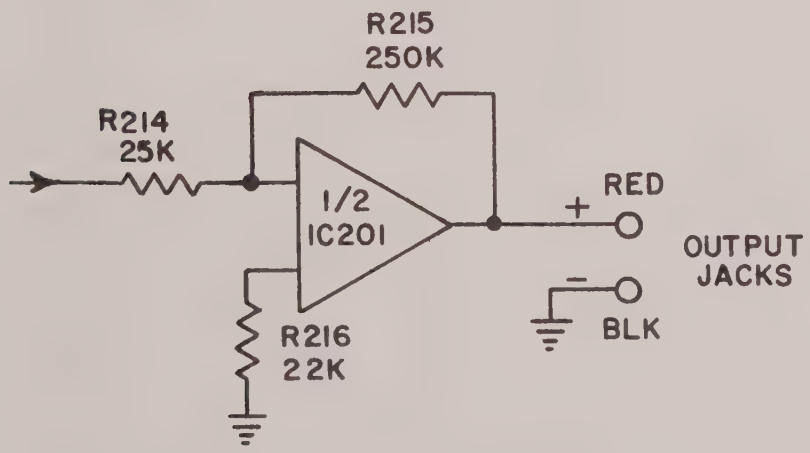
10 VOLT OUTPUT OPTION

The analog output voltage of modular gaussmeters with the "H" option is changed to 10.00 volts full scale. This voltage output is provided at the front panel jacks of the model 8860 field detector and at the rear panel access connector.

All specifications and operating instructions are applicable except references to 1.000 volt output and overrange capability. References to output voltage in operating and calibration instructions should be multiplied by a factor of ten. Overrange capability is approximately 30%.

The 10 volt output is provided by a gain change of the output amplifier-filter stage in the Model 8860 field detector. Resistance values of resistors R215 and R216 are changed from 25K and 12.4K to 250K and 22K, respectively.

Shown below is a simplified diagram of the output amplifier with resistor values for 10 volt output.



ABBREVIATIONS

Cer	Ceramic	Ω	ohm
Comp	Composition	p	pico or 10^{-12}
EM	Electrolytic Miniature type	Pcb	Polycarbonate
F	Farad	Pst	Polystyrene
Film	Metal film	V	Working volts
FOP	Factory adjusted for optimum performance	Var	Variable
HM	Hot Molded	W	Watt
K	Kilo or 10^3	WW	Wirewound
M	Meg or 10^6		
μ	Micro or 10^{-6}		
FM	Miniature film		

PARTS LIST MODEL 8860

Note: Components with schematic reference numbers below 100 are located in the chassis wiring; numbers from 101 through 199 are located on the main circuit board; numbers from 201 through 299 are located on the output amplifier/filter circuit board.

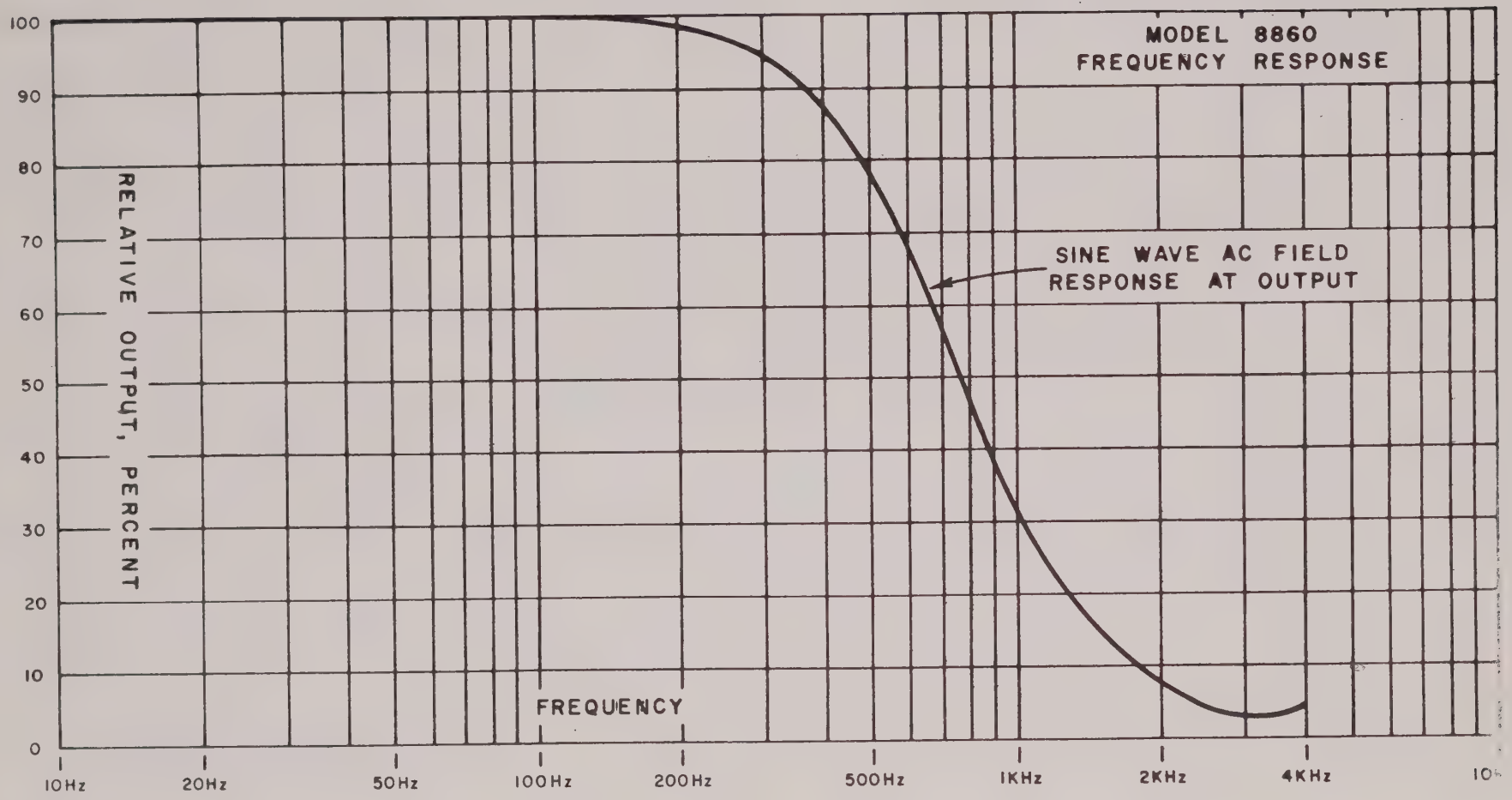
Schematic Ref.	Value	Spec.		Type	Bell Part No.
R1	5 kΩ			WW Var	RB-1503-008
R2	5 kΩ			HM Var	RB-505-034
R3	25 Ω	1/10 W	.1%	WW Fixed	RL-18-25
R4	25 Ω	1/10 W	.1%	WW Fixed	RL-18-25
R5	110 kΩ	¼ W	1%	Film Fixed	RK-23-110K
R6	110 kΩ	¼ W	1%	Film Fixed	RK-23-110K
R7	909 kΩ	¼ W	1%	Film Fixed	RK-23-909K
R8	10 kΩ	¼ W	1%	Film Fixed	RK-23-10K
R9	25 Ω			WW Var	RB-477-016
R10	5 kΩ			WW Var	RB-1503-008
R11	500 Ω	1/3 W	.01%	WW Fixed	RL-24-500
R12	4.5 kΩ	1/3 W	.01%	WW Fixed	RL-24-4X5K
R13	1.21 kΩ	¼ W	1%	Film Fixed	RK-23-1X21K
R14					
R15	45 kΩ	1/3 W	.01%	WW Fixed	RL-24-45K
R16	4.02 kΩ	¼ W	1%	Film Fixed	RK-23-4X02K
R17	4.5 kΩ	1/3 W	.01%	WW Fixed	RL-24-4X5K
R18	500 Ω	1/3 W	.01%	WW Fixed	RL-24-500
R19	10 kΩ	¼ W	1%	Film Fixed	RK-23-10K
R20	127 kΩ	¼ W	1%	Film Fixed	RK-23-127K
R101	75 kΩ	½ W	5%	Comp Fixed	
R102	16.2 kΩ	¼ W	1%	Film Fixed	RK-23-16X2K
R103	100 kΩ	½ W	5%	Comp Fixed	
R104	47 kΩ	½ W	5%	Comp Fixed	
R21	9.76 K	¼ W	1%	Film Fixed	RK-23-9X76K

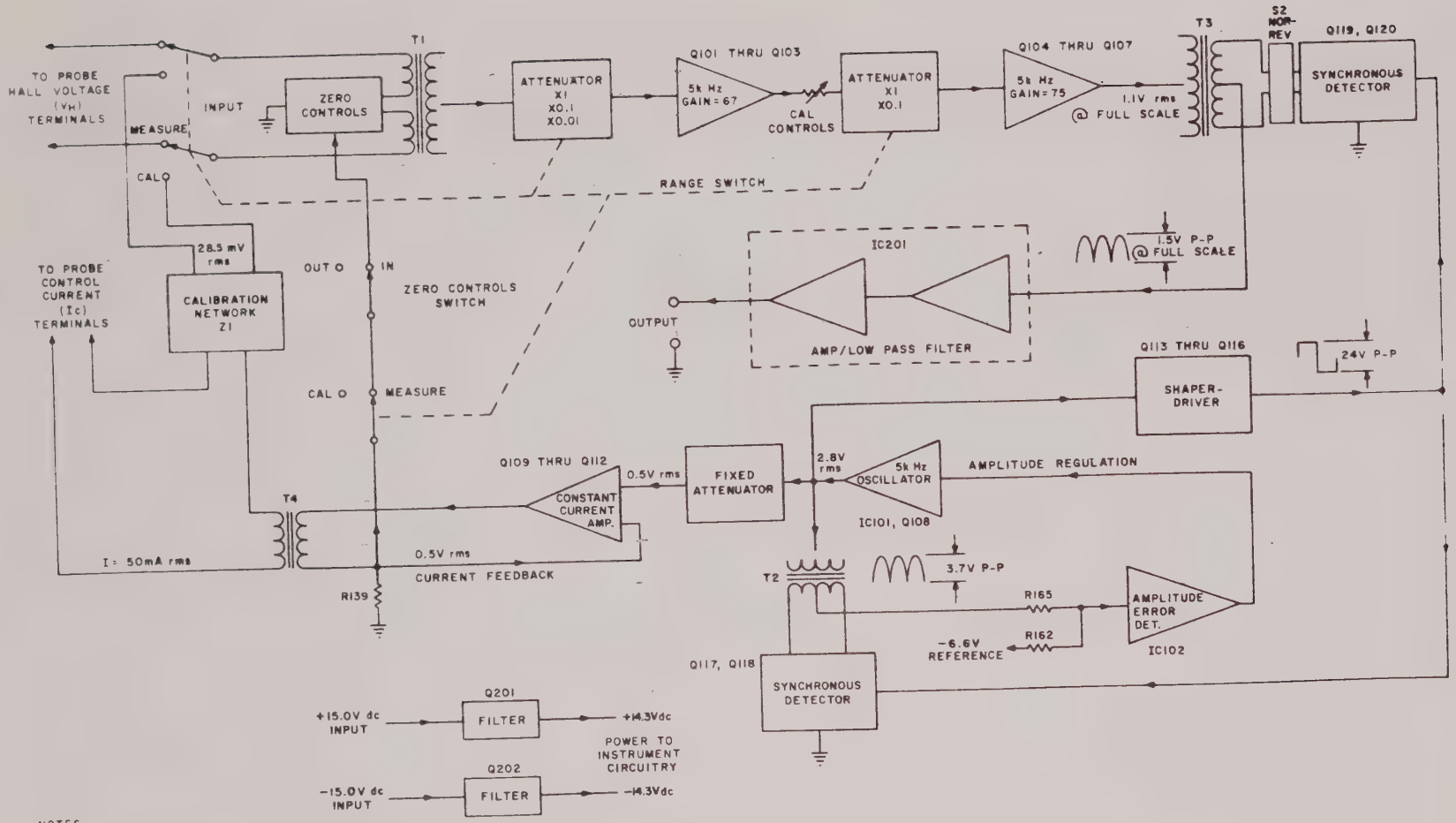
Schematic Ref.	Value	Spec.	Type	Bell Part No.
R105	300 Ω	1/10 W 1%	WW Fixed	RL-20-300
R106	1.8 kΩ	½ W 5%	Comp Fixed	
R107	5.6 kΩ	½ W 5%	Comp Fixed	
R108	5.6 kΩ	½ W 5%	Comp Fixed	
R109	20 kΩ -50 PPM	1/3 W .5%	WW Fixed	RL-25-20K
R110	FOP		Fixed	
R111	1.6 kΩ	½ W 5%	Comp Fixed	
R112	1.3 kΩ	½ W 5%	Comp Fixed	
R113	100 kΩ	½ W 5%	Comp Fixed	
R114	127 kΩ	¼ W 1%	Film Fixed	RK-23-127K
R115	100 kΩ	½ W 5%	Comp Fixed	
R116	62 kΩ	½ W 5%	Comp Fixed	
R117	300 Ω	1/10 W 1%	WW Fixed	RL-20-300
R118	16.2 kΩ	¼ W 1%	Film Fixed	RK-23-16X2K
R119	1.6 kΩ	½ W 5%	Comp Fixed	
R120	22.5 kΩ	½ W 1%	WW Fixed	RL-23-22X5K
R121	5.1 kΩ	½ W 5%	Comp Fixed	
R122	5.1 kΩ	½ W 5%	Comp Fixed	
R123	47 Ω	½ W 5%	Comp Fixed	
R124	47 Ω	½ W 5%	Comp Fixed	
R125	390 Ω	½ W 5%	Comp Fixed	
R126	10 MΩ	½ W 5%	Comp Fixed	
R127	10 kΩ	¼ W 1%	Film Fixed	RK-23-10K
R128	11 kΩ	¼ W 1%	Film Fixed	RK-23-11K
R129	7.5 kΩ	¼ W 1%	Film Fixed	RK-23-7X5K
R130	1 kΩ	½ W 5%	Comp Fixed	
R131	100 kΩ	¼ W 1%	Film Fixed	RK-23-100K
R132	100 kΩ	¼ W 1%	Film Fixed	RK-23-100K
R133	FOP		Fixed	
R134	10 kΩ	1/10 W 1%	WW Fixed	RL-20-10K
R135	30.1 kΩ	¼ W 1%	Film Fixed	RK-23-30X1K
R136	5.6 kΩ	½ W 5%	Comp Fixed	
R137	39.2 kΩ	¼ W 1%	Film Fixed	RK-23-39X2K
R138	2.5 kΩ	1/10 W 1%	WW Fixed	RL-20-2X5K
R139	10 Ω	1 W 1%	WW Fixed	RL-26-10
R140	2.7 kΩ	½ W 5%	Comp Fixed	
R141	3 kΩ	½ W 5%	Comp Fixed	
R142	620 Ω	½ W 5%	Comp Fixed	
R143	620 Ω	½ W 5%	Comp Fixed	
R144	10 Ω	½ W 5%	Comp Fixed	
R145	10 Ω	½ W 5%	Comp Fixed	
R146	10 Ω	½ W 5%	Comp Fixed	
R147	39.2 kΩ	¼ W 1%	Film Fixed	RK-23-39X2K
R148	22.1 kΩ	¼ W 1%	Film Fixed	RK-23-22X1K
R149	1 kΩ	½ W 5%	Comp Fixed	
R150	2.7 k	½ W 5%	Comp Fixed	
R151	100 k	½ W 5%	Comp Fixed	
R152	10 k	½ W 5%	Comp Fixed	
R153	10 k	½ W 5%	Comp Fixed	
R154	47 Ω	½ W 5%	Comp Fixed	

Schematic Ref.	Value	Spec.		Type	Bell Part No.
R155	150 Ω	½ W	5%	Comp Fixed	
R156	150 Ω	½ W	5%	Comp Fixed	
R157	47 Ω	½ W	5%	Comp Fixed	
R158	2.4 kΩ	½ W	5%	Comp Fixed	
R159	390 Ω	½ W	5%	Comp Fixed	
R160	3.74 kΩ	¼ W	1%	Film Fixed	RK-23-3X74K
R161	7.5 kΩ	¼ W	1%	Film Fixed	RK-23-7X5K
R162	25 kΩ	½ W	1%	WW Fixed	RL-23-25K
R163	5 kΩ			Var	RQ-11-5K
R164	800 Ω	1/10 W	1%	WW Fixed	RL-20-800
R165	10 kΩ	1/10 W	1%	WW Fixed	RL-20-10K
R166	FOP			Fixed	
R167	2.4 kΩ	½ W	5%	Comp Fixed	
R168	2.4 kΩ	½ W	5%	Comp Fixed	
R169	2.4 kΩ	½ W	5%	Comp Fixed	
R170	100 Ω	½ W	5%	Comp Fixed	
R171	2.4 kΩ	½ W	5%	Comp Fixed	
R201	10 kΩ	1/10 W	1%	WW Fixed	RL-20-10K
R202	10 kΩ	1/10 W	1%	WW Fixed	RL-20-10K
R203	576 Ω	¼ W	1%	Film Fixed	RK-23-576
R204	2.32 kΩ	¼ W	1%	Film Fixed	RK-23-2X32K
R205	2.32 kΩ	¼ W	1%	Film Fixed	RK-23-2X32K
R206	2.32 kΩ	¼ W	1%	Film Fixed	RK-23-2X32K
R207	2.32 kΩ	¼ W	1%	Film Fixed	RK-23-2X32K
R208	14.3 kΩ	¼ W	1%	Film Fixed	RK-23-14X3K
R209	100 Ω	¼ W	1%	Film Fixed	RK-23-100
R210	249 kΩ	¼ W	1%	Film Fixed	RK-23-249K
R211	25 kΩ			Var	RQ-10-25K
R212	1.5 kΩ	½ W	5%	Comp Fixed	
R213	47 Ω	½ W	5%	Comp Fixed	
R214	25 kΩ	½ W	1%	WW Fixed	RL-23-25K
R215	25 kΩ	½ W	1%	WW Fixed	RL-23-25K
R216	12.4 kΩ	¼ W	1%	Film Fixed	RK-23-12X4K
R217	1.5 kΩ	½ W	5%	Comp Fixed	
R218	200 Ω	½ W	5%	Comp Fixed	
C101	10 µF	16 V		EM	
C102	0.68 µF	100 V	10%	Pcb	CMK-04-X68MF
C103	270 pF	1000 V	10%	Cer	
C104	10 µF	16 V		EM	
C105	82 pF	1000 V	10%	Cer	
C106	10 µF	16 V		EM	
C107	150 pF	500 V	5%	Pst	CLW-02-150pF
C108	100 µF	12 V		EM	
C109	100 µF	12 V		EM	
C110	10 µF	16 V		EM	
C111	10 µF	16 V		EM	
C112	0.68 µF	100 V	10%	Pcb	CMK-04-X68MF
C113	270 pF	1000 V	10%	Cer	
C114	10 µF	16 V		EM	
R172	110 Ω	½ W	5%	Comp Fixed	
R173	100 K	½ W	5%	Comp Fixed	

Schematic Ref.	Value	Spec.		Type	Bell Part No.
C115	82 pF	1000 V	10%	Cer	
C116	100 pF	500 V	5%	Pst	CLW-02-100PF
C117	FOP	1000 V	10%	Cer	
C118	10 µF	16 V		EM	
C119	100 µF	25 V		EM	
C120	100 µF	12 V		EM	
C121	330 pF	500 V	5%	Pst	CLW-02-330PF
C122	0.0033 µF	500 V	5%	Pst	CLW-02-X0033MF
C123	0.0022 µF	200 V	10%	FM	
C124	0.68 µF	100 V	10%	Pcb	CMK-04-X68MF
C125	10 µF	16 V		EM	
C126	10 µF	16 V		EM	
C127	100 µF	12 V		EM	
C128	0.1 µF	200 V	10%	FM	
C129	100 µF	12 V		EM	
C130	82 pF	1000 V	10%	Cer	
C131	100 µF	12 V		EM	
C132	270 pF	1000 V	10%	Cer	
C133	100 µF	25 V		EM	
C134	10 µF	16 V		EM	
C135	10 µF	16 V		EM	
C136	25 µF	16 V		EM	
C137	25 µF	16 V		EM	
C138	0.0022 µF	200 V	10%	FM	
C139	1 µF	100 V	10%	Pcb	CMK-02-1MF
C140	0.0033 µF	200 V	10%	FM	
C201	0.01 µF	500 V	5%	Pst	CLW-02-X01MF
C202	0.01 µF	500 V	5%	Pst	CLW-02-X01MF
C203	0.033 µF	200 V	10%	FM	
C204	0.01 µF	500 V	5%	Pst	CLW-02-X01MF
C205	0.1 µF	200 V	10%	FM	
C206	0.015 µF	200 V	10%	FM	
C207	0.0047 µF	200 V	10%	FM	
C208	220 pF	1000 V	10%	Cer	
C209	0.1 µF	20 V		Cer	
C210	0.1 µF	20 V		Cer	
C211	0.0047 µF	200 V	10%	FM	
C212	220 pF	1000 V	10%	Cer	
C213	25 µF	16 V		EM	
C214	25 µF	16 V		EM	
C215	100 µF	25 V		EM	
C216	100 µF	25 V		EM	
D101		MZ2360		Diode	
D102		MZ2360		Diode	
D103		MZ2360		Diode	
D104		MZ2360		Diode	
D105		MZ2360		Diode	

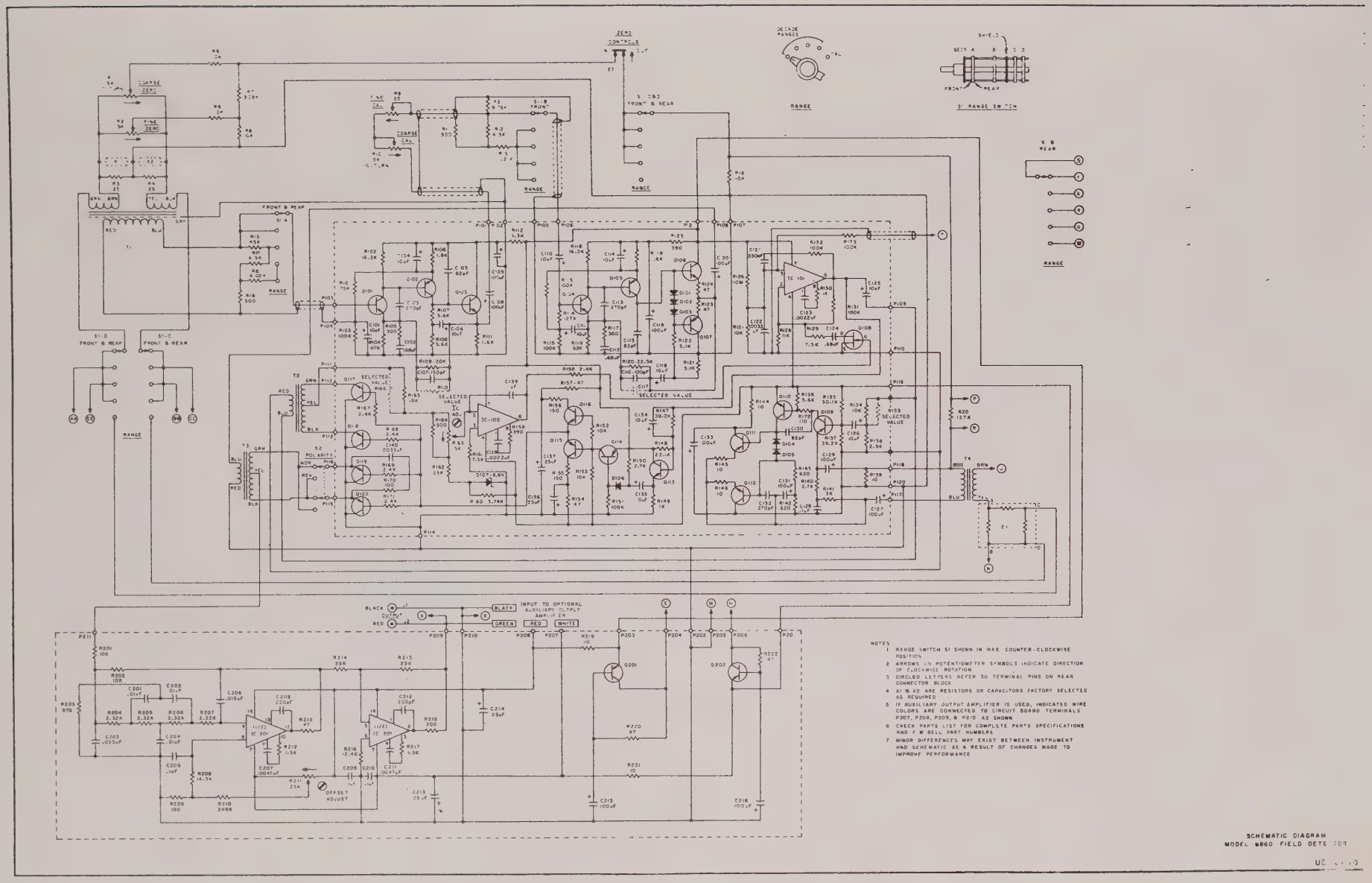
Schematic Ref.	Value	Spec.	Type	Bell Part No.
D106		1N4611A	Reference Diode	JT-1N4611A
IC-101		MC-1439G	Integrated Circuit	JM-01-004
IC-102		MC-1439G	Integrated Circuit	JM-01-004
IC-201		MC-1437L	Integrated Circuit	JM-01-003
S1		Rotary Switch		SA-1861
S2		DPDT Toggle Switch		ST-01-008
S3		DPDT Slide Switch		SA-1862
T1		Input Transformer		LA-1948
T2		Output Transformer		LA-1370
T3		Output Transformer		LA-1370
T4		Current Output Transformer		LA-1950
Q101		2N5088	Transistor	
Q102		2N5087	Transistor	
Q103		2N4124	Transistor	
Q104		2N5088	Transistor	
Q105		2N5087	Transistor	
Q106		2N4124	Transistor	
Q107		2N4126	Transistor	
Q108		2N5163	Transistor	
Q109		2N5087	Transistor	
Q110		2N4124	Transistor	
Q111		2N4403	Transistor	
Q112		2N4401	Transistor	
Q113		2N1304	Transistor	
Q114		2N4403	Transistor	
Q115		2N4403	Transistor	
Q116		2N4401	Transistor	
Q117		2N1304	Transistor	
Q118		2N1305	Transistor	
Q119		2N1304	Transistor	
Q120		2N1305	Transistor	
Q201		2N5190	Transistor	
Q202		2N5193	Transistor	
Z1		Resistance Network		RB-1814


MODEL 8860
FREQUENCY RESPONSE
SINE WAVE AC FIELD
RESPONSE AT OUTPUT
RELATIVE OUTPUT, PERCENT
100
90
80
70
60
50
40
30
20
10
0
FREQUENCY
10Hz
20Hz
50Hz
100Hz
200Hz
500Hz
1KHz
2KHz
4KHz



NOTES

1. RMS VOLTAGES ARE 5k Hz SINE WAVE.
2. SIGNAL LEVELS ARE TYPICAL VALUES INTENDED TO ASSIST IN TROUBLESHOOTING. NO ATTEMPT SHOULD BE MADE TO ADJUST A PROPERLY OPERATING INSTRUMENT TO THESE EXACT VALUES.



NOTES

1. RANGE SWITCH S1 SHOWN IN MAX COUNTER-CLOCKWISE POSITION
2. ARROWS ON POTENTIOMETER SYMBOLS INDICATE DIRECTION OF CLOCKWISE ROTATION
3. CIRCLED LETTERS REFER TO TERMINAL PINS ON REAR CONNECTOR BLOCK
4. X1 & X2 ARE RESISTORS OR CAPACITORS FACTORY SELECTED AS REQUIRED
5. IF AUXILIARY OUTPUT AMPLIFIER IS USED, INDICATED WIRE COLORS ARE CONNECTED TO CIRCUIT BOARD TERMINALS P207, P208, P209, & P210 AS SHOWN
6. CHECK PARTS LIST FOR COMPLETE PART'S SPECIFICATIONS AND F.W. BELL PART NUMBERS
7. MINOR DIFFERENCES MAY EXIST BETWEEN INSTRUMENT AND SCHEMATIC AS A RESULT OF CHANGES MADE TO IMPROVE PERFORMANCE

SCHEMATIC DIAGRAM
MODEL 6060 FIELD DETE [illegible]

UE [illegible]

MODEL 8510
BENCH CABINET

INSTRUCTION AND SERVICE MANUAL

Subsidiary,
Magnetics & Electronics, Inc.

BELL INC.
6120 Hanging Moss Road
Orlando, Florida 32807
Phone: 305-678-6900
TWX: 810-853-3115

UN-01-044

CONTENTS

SECTION I	GENERAL DESCRIPTION	1
	I-1 General	1
SECTION II	SPECIFICATIONS	2
	II-1 Electrical Specifications	2
	II-2 Physical Specifications	2
	II-3 Controls and Connectors	3
SECTION III	MAINTENANCE	4
	III-1 Circuit Operation	4
	III-2 Adjustments and Repair	4

SECTION I

GENERAL DESCRIPTION

I-1 General:

The Model 8510 Bench Cabinet is a versatile electronic packaging unit designed to accommodate F. W. Bell, Inc. instrumentation modules. It contains a power supply for operation of the wide variety of standard and special module combinations which may be used. The plug-in modular concept simplifies maintenance and in many cases permits future changes in function or capability by adding or replacing modules without requiring internal wiring changes. The Model 8510 may easily be modified for special applications if required.

SECTION II

SPECIFICATIONS

II-1 Electrical Specifications:

(a) The internal power supply provides dc output voltages with respect to circuit common as follows:

1. +15 V regulated
2. -15 V regulated
3. +24 V nominal unregulated
4. -24 V nominal unregulated
5. + 5 V regulated

(b) Each output voltage is capable of supplying a maximum load current of 300 mA, with the total of load currents supplied by all outputs not to exceed 950 mA.

(c) 1. Combined line and load regulation of the plus and minus 15 volt supplies does not exceed 0.1% with less than 10 mV P-P ripple @ 300 mA output.

2. Combined line and load regulation of the plus 5 volt supply does not exceed 5% with less than 10 mV P-P ripple @ 300 mA output.

(d) Power Requirements: 105-130 or 210-260 volts 50-60 Hz @ 60 volt-amperes maximum.

II-2 Physical Specifications:

F. W. Bell, Inc. instrumentation module packages are designed with overall front panel height of 6-5/8 inches and widths in increments of 1-3/8 inches. Thus a two width module would be 2-3/4 inches wide; a triple width module 4-1/8 inches wide. The Model 8510 Bench Cabinet will physically accept a total of six module widths. It is normally supplied with wiring and connectors so that instruments such as the following may be made up simply by plugging in the required modules.

Instrument:	Modules Required:
(a) Model 810 Field Monitor	(One) Model 8511 Control Panel (One) Model YL-2167 Two Width Filler Panel (One) Model 8860 Field Detector
(b) Model 811 Digital Gaussmeter	(One) Model 8880 Digital Readout (One) Model 8860 Field Detector

(c) Model 813 Magnet Sorter

(One) Model 8511 Control Panel
(One) Model 8921 2-Level Classifier or
Model 8922 3-Level Classifier
(One) Model 8860 Field Detector

II-3 Controls and Connectors:

(a) The power cord connector accepts the detachable power cord. The three wire cord is terminated with a 3-prong plug having a round pin which grounds the instrument case when used with the appropriate receptacle. An adapter may be used for connection to a two contact outlet. The green wire brought out of the adapter should then be connected to a suitable ground for protection of operating personnel. Only when a ground is supplied by associated equipment should this ground be unused to prevent common ground currents.

(b) The 115-230 volt slide switch connects the input to the digital readout and the primary of the internal power supply transformer for operation from either voltage input at 50-60 Hz.

(c) The fuse holder accepts a standard 3 AG slow blow fuse. The 8510 is normally supplied with a 1/2 A fuse. If desired, a 1/4 A type may be used for operation at 230 V line for somewhat greater protection against instrument overload damage.

(d) Multi-pin connector blocks are used to make necessary interconnections with the modules. Guide pins are arranged to prevent engagement of the connector with an incorrect module.

SECTION III

MAINTENANCE

III-1 Circuit Operation:

A conventional full wave center-tapped bridge rectifier circuit is used to obtain the plus and minus 24 volt outputs and to supply the regulators which provide the regulated outputs. The plus 5 volt regulator consists of series pass transistor Q1 with zener diode CR103 and temperature compensating diode CR102 supplying the reference. The minus 15 volt regulator uses Q103 as an error amplifier to sense the difference between the zener reference voltage and a portion of the output. Its output drives Q104 which controls series pass transistor Q3. The positive 15 volt regulator operates in a similar manner with complementary transistor types. Its reference, however, is obtained from a divider between the minus 15 volt and plus 15 volt outputs. The positive output voltage thus tends to track the negative output.

III-2 Adjustments and Repair:

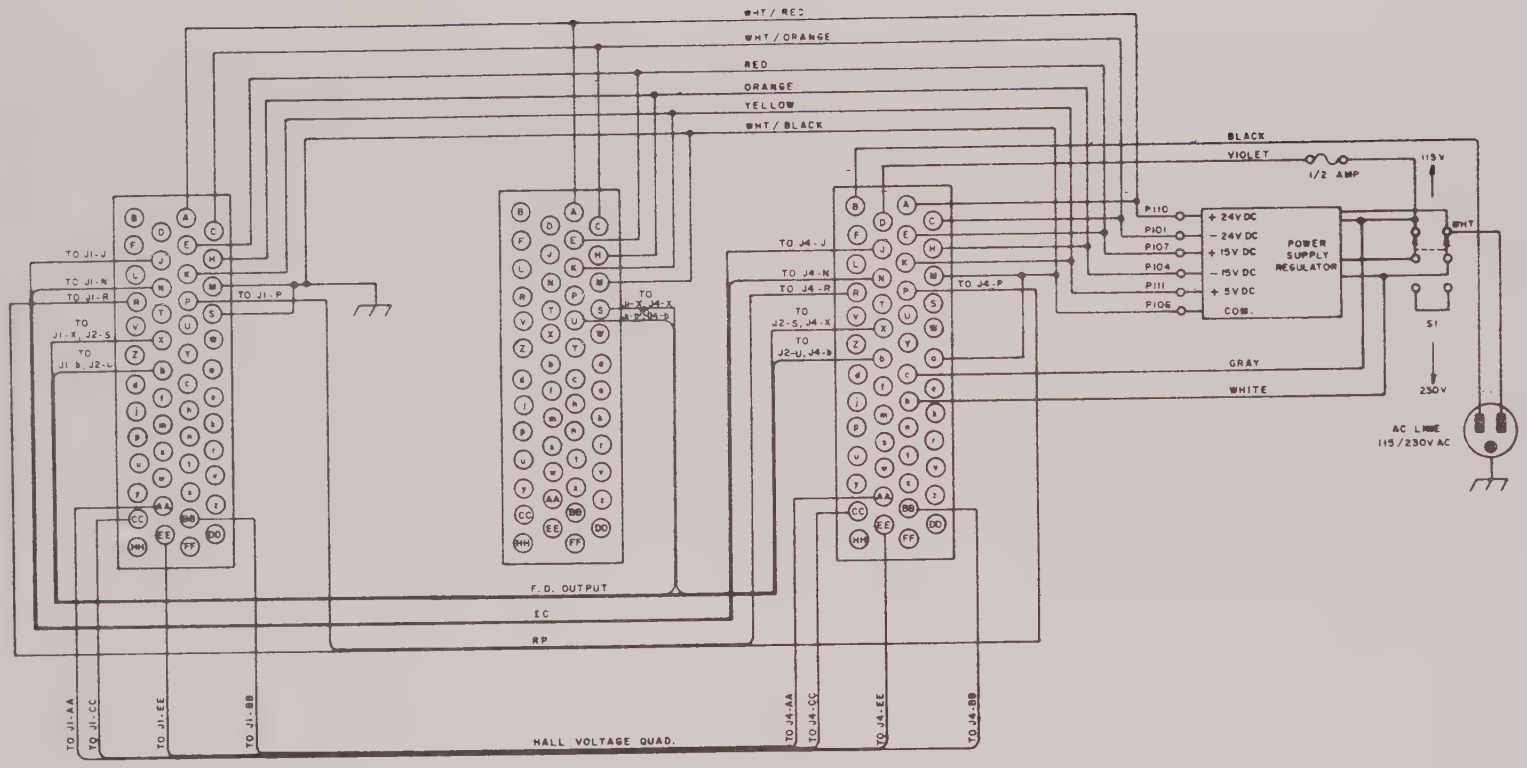
The two output voltage adjustment potentiometers R108 and R116 have been factory adjusted to provide very accurate plus and minus 15 volt outputs. They should not require readjustment unless components are replaced. If it is determined that adjustment is necessary, R108 must be adjusted first to obtain the minus 15 volt output. Then R116 may be adjusted for proper positive output.

Refer to the circuit diagrams and to the parts list, by using schematic reference symbols, to obtain detailed information on parts used.

It is important to replace parts with the same type and electrical value as originally used. Parts having F. W. Bell, Inc. part numbers include those designed especially for the Model 8510 and those which may not be readily available from normal repair parts outlets. These may be obtained directly from the factory.

Use particular care in replacing diodes and transistors; do not apply excessive heat to the leads. A heat sink is recommended, such as gripping with pliers on the lead between the body of the component and the soldering iron.

If necessary to return this instrument to the factory for repair, refer to WARRANTY section.

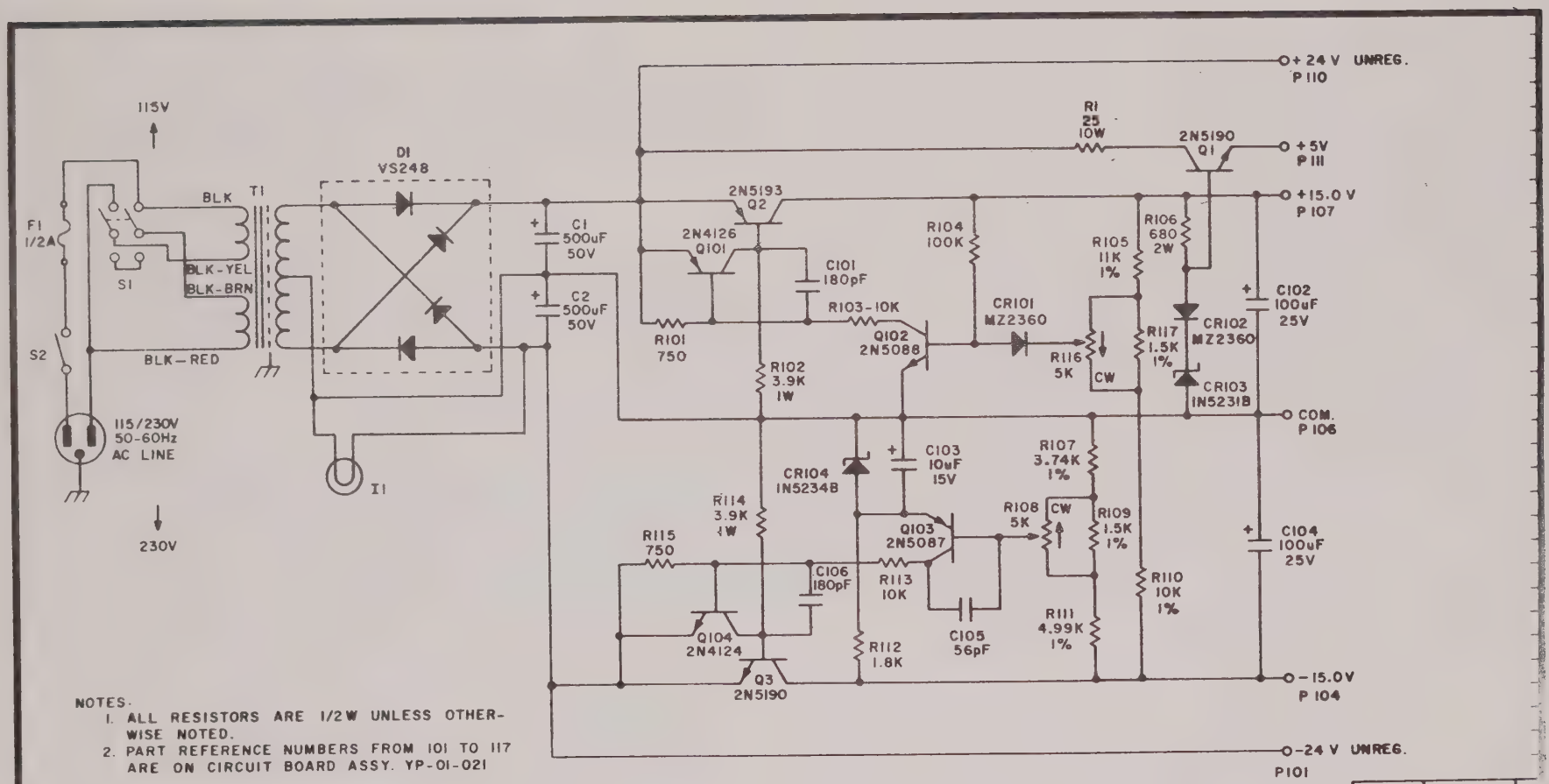


J4
FIELD DETECTOR

J2
CLASSIFIER

J1
CONTROL PANEL
OR
DIGITAL READOUT

MATERIAL	Orlando, Florida BELL INC		SHEET OF	1082 ECO NO	DEC.69 DATE
FINISH	SCALE	DWG 8,OCT.69 DE	TITLE SCHEMATIC WIRING DIAGRAM MODEL 8510 BENCH CABIN.		
	DEC ±	CKD			
DIVISION	FRAC ±	APR 21	ISSUE DATE	DWG NO	UC-22
	ANG ±	REL			



NOTES:
1. ALL RESISTORS ARE 1/2W UNLESS OTHERWISE NOTED.
2. PART REFERENCE NUMBERS FROM 101 TO 117 ARE ON CIRCUIT BOARD ASSY. YP-01-021

1194	13, NOV 70 DE	C		
1103	[illegible]	B		
[illegible]	[illegible]	[illegible]		
E.C.O NO.	DATE BY	REV		

MATERIAL	Orlando, Florida BELL INC		SHEET OF	
FINISH	SCALE NONE	DWG. 23, APR. 69 DE	TITLE	SCHEMATIC DIAGRAM FOR MODEL 8510 POWER SUPPLY
	DEC. ±	CKD.		
DIVISION	FRAC. ±	APR	ISSUE DATE	DWG NO UB-2220
DEV DWG. NO	ANG. ±	REL.		

ABBREVIATIONS

Cer	Ceramic	μ	Micro or 10^{-6}
Comp	Composition	Ω	Ohm
EM	Electrolytic miniature type	p	Pico or 10^{-12}
F	Farad	V	Working volts
Film	Metal film	Var	Variable
K	Kilo or 10^{3}	W	Watt
M	Meg or 10^{6}	WW	Wire wound

PARTS LIST MODEL 8510

Note: Components with schematic reference numbers below 100 are located in the chassis wiring; numbers above 100 are located on the regulator circuit board.

Schematic Ref.	Value	Spec.		Type	Bell Part No.
R1	50 Ω	10 W	10%	WW Fixed	RH-08-50
R101	750 Ω	½ W	5%	Comp Fixed	
R102	3.9 kΩ	1 W	5%	Comp Fixed	
R103	10 kΩ	½ W	5%	Comp Fixed	
R104	100 kΩ	½ W	5%	Comp Fixed	
R105	11 kΩ	¼ W	1%	Film Fixed	RK-23-11K
R106	680 Ω	2 W	5%	WW Fixed	RL-13-680
R107	3.74 kΩ	¼ W	1%	Film Fixed	RK-23-3X74K
R108	5 kΩ			Film Var	RQ-10-5K
R109	1.5 kΩ	¼ W	1%	Film Fixed	RK-23-1X5K
R110	10 kΩ	¼ W	1%	Film Fixed	RK-23-10K
R111	4.99 kΩ	¼ W	1%	Film Fixed	RK-23-4X99K
R112	1.8 kΩ	½ W	5%	Comp Fixed	
R113	10 kΩ	½ W	5%	Comp Fixed	
R114	3.9 kΩ	1 W	5%	Comp Fixed	
R115	750 Ω	½ W	5%	Comp Fixed	
R116	5 kΩ			Film Var	RQ-10-5K
R117	1.5 kΩ	¼ W	1%	Film Fixed	RK-23-1X5K
C1	500 μF	50 V		EM	CFH-77-500MF
C2	500 μF	50 V		EM	CFH-77-500MF
C101	180 pF	1000 V	20%	Cer	
C102	100 μF	25 V		EM	CFH-56-100MF
C103	10 μF	16 V		EM	CFH-47-10MF
C104	100 μF	25 V		EM	CFH-56-100MF
C105	56 pF	1000 V	20%	Cer	
C106	180 pF	1000 V	20%	Cer	

Schematic Ref.	Value		Spec.	Type	F. W. Bell Part No
CR101			MZ2360	Diode	JF-01-004
CR102			MZ2360	Diode	JF-01-004
CR103	5.1 V	5%	1N5231B	Zener Diode	JT-1N5231B
CR104	6.2 V	5%	1N5234B	Zener Diode	JT-1N5234B
D1			VS248	Full Wave Bridge	JF-06-003
Q101			2N4126	Transistor	
Q102			2N5088	Transistor	
Q103			2N5087	Transistor	
Q104			2N4124	Transistor	
Q1			2N5190	Transistor	
Q2			2N5193	Transistor	
Q3			2N5190	Transistor	
S1				DPDT Slide Switch	SW-01-004
T1				Power Transformer	LB-1954
F1			½ A 3AG Slow Blow		

WARRANTY

F. W. BELL, INC. warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to replacing any defective parts thereof (excluding electron tubes, batteries, semiconductor devices and probe sensing elements, which parts are covered by a standard EIA 90 day warranty). This warranty covers instruments which, within one year after delivery to the original purchaser, shall be returned with transportation charges prepaid by the original purchaser, and which upon examination shall disclose to our satisfaction to be defective. If it is determined that the defect has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost after submitting an estimate to the purchaser.

F. W. BELL, INC. reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

This warranty is expressly in lieu of all other obligations or liabilities on the part of F. W. BELL, INC. and F. W. BELL, INC. neither assumes nor authorizes any other person to assume for them any other liability in connection with the sales of F. W. BELL, INC. instruments.

Damage In Shipment

The instrument should be examined and tested as soon as it is received. If it does not operate properly, or is damaged in any way, immediately file a claim with the carrier. The claim agent will provide report forms. A copy of the completed form should be forwarded to us. We will then make the necessary arrangements for repair or replacement. All correspondence concerning this instrument should include model and serial numbers.

Shipping Instructions

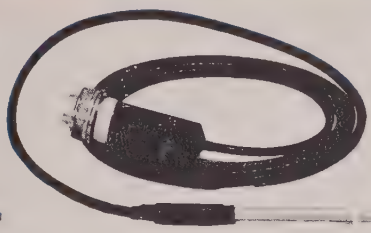
All shipments of F. W. BELL, INC. instruments should be made via Railway Express or Motor Freight. Always use the original shipping carton and inserts, if possible, or pack the instrument in a sturdy container and surround the entire instrument with two or three inches of excelsior or similar shock-absorbing material.

F. W. BELL, INC.
6120 Hanging Moss Rd.
Orlando, Florida 32807
Phone: 305-678-6900
TWX: 810-853-3115

F.W.BELL

GAUSSMETER PROBES

THIRD GENERATION



DESCRIPTION

The third generation of Bell gaussmeter probes is comprised of a wide range of probe models designed to meet the electrical and mechanical requirements of virtually any application. The probes are precision, solid state magnetic field sensors built for accurate, repeatable, stable field measurements. Models are available for transverse, axial, two axis, or three axis field measurements with a variety of field measurements ranges, field sensitivities and physical configurations for each. Calibrated extension cables and high sensitivity magnaprobes are also available.

The third generation supercedes and replaces all other Bell gaussmeter probes. The lower price, improved quality, and increased model selection are the benefits of new technology and experience. Individual probe linearity curves are available as an option. CAUTION! Probes are fragile! Handle with care!

MODEL NUMBERING

Each probe model is classified with a three letter, five numeral model number. The chart below shows the significance of each letter and numeral. At the factory the assembled probes are calibrated to match the input characteristics of each gaussmeter model. The model to which the probe is calibrated is indicated by a numeral in the fourth space of the model number. A model SAE1-0602 will operate properly with any model 610 gaussmeter. The model SAE6-0602 will only work with a model 660 gaussmeter although it is physically identical to the SAE1-0602. With their proper respective gaussmeters the probe model SAE1-0602 and model SAE6-0602 have the same characteristics. Thus, to simplify the model listing the fourth space has been omitted. Please insert the number which corresponds to the gaussmeter that will be used with the probe. The sensitivity number is the constant by which the meter reading is multiplied to obtain the actual reading.

S A E 1 — 06 02

GAUSSMETER

1 – 610 / 615	6 – 660
4 – 620 / 640	8 – 800 SERIES
0 – ALL TYPES (ext. cables only)	

PROBE TYPE

A – AXIAL
T – TRANSVERSE
O – NOT APPLICABLE

PROBE STYLE

C – CRYOGENIC
F – FLEXIBLE
H – HEAVY DUTY
S – STANDARD
D – DIFFERENTIAL
M – MAGNA
Y – 2 AXIS
Z – 3 AXIS
X – EXTENSION CABLE

ELECTRICAL PERFORMANCE

B – 1.0%	10kG	1X
E – 2.0%	10kG	1X
G – 2.0%	30kG	1X
I – 3.0%	10kG	1X
J – 0.1%	10kG	10X
K – 0.25%	10kG	10X
L – 0.25%	30kG	10X
N – 0.5%	30kG	10X
P – 1.0%	30kG	10X
R – 1.0%	100kG	10X
U – 2.0%	100kG	10X
W – 2.5%	2G	.01X

Q – CALIBRATED
V – UNCALIBRATED

OD OR THICKNESS

AXIAL OD
06 – .060 IN.
08 – .080 IN.
09 – .090 IN.
12 – .120 IN.
18 – .180 IN.
25 – .250 IN.
32 – .320 IN.

THICKNESS
00 – .010 IN.
01 – .015 IN.
02 – .020 IN.
03 – .030 IN.
04 – .040 IN.
06 – .060 IN.
25 – .250 IN.

PROBE LENGTH

02 – 2 IN.
04 – 4 IN.
06 – 6 IN.
08 – 8 IN.
15 – 15 IN.
18 – 18 IN.
36 – 36 IN.
48 – 48 IN.
60 – 60 IN.

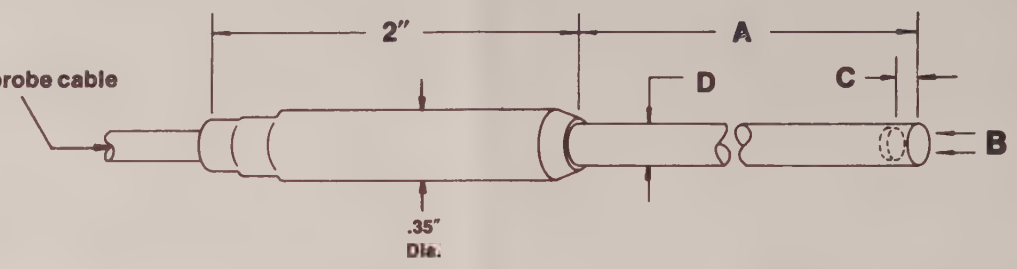
EXTENSION CABLE LENGTH

0010 – 10 FT.
0025 – 25 FT.
0050 – 50 FT.
0100 – 100 FT.

REVISION EFFECTIVE 1 JANUARY 1983 Printed in USA NUMBER 60700

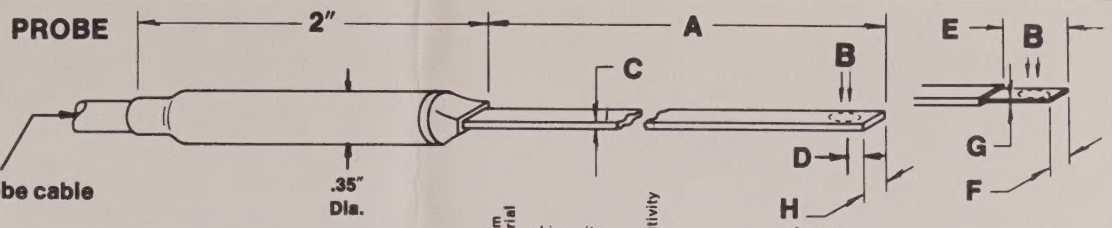
AXIAL PROBE

Includes 5 foot probe cable



Model	Price	A	D	C	Stem Material	Linearity % of Reading	Sensitivity	Active Area	Operating Temperature Range	Temperature Stability (max.) Zero	Temperature Stability (max.) Calibrate
SAE— -0602	$700	2" ± .063	.060" +.001 —.003	.005" ±.002	Aluminum	2% to 10 kG	1x blue	.020" dia. nom.	0°C to +75°C	±.20 Gauss /°C	—.08% /°C
SAE— -0608	715	8" ± .125									
SAE— -0618	730	18" ± .125									
SAE— -0802	605	2" ± .063	.080" ±.003								
SAE— -0808	620	8" ± .125									
SAE— -0818	645	18" ± .125									
SAE— -0836	670	36" ± .25									
SAB— -1202	470	2" ± .063	.120" +.000 —.005			1% to 10 kG		.030" dia. nom.		±.13 Gauss /°C	±.005% /°C
SAB— -1208	490	8" ± .125									
SAB— -1218	505	18" ± .125									
SAB— -1236	540	36" ± .25									
SAK— -1802	375	2" ± .063	.180" +.002 —.004	.010" ±.002		.25% to 10 kG	10x red				
SAK— -1808	395	8" ± .125									
SAK— -1818	400	18" ± .125									
SAK— -1836	440	36" ± .25									
SAN— -1802	460	2" ± .063				.5% to 30 kG					
SAN— -1808	480	8" ± .125									
SAN— -1818	495	18" ± .125									
SAN— -1836	535	36" ± .25									
SAR— -1802	550	2" ± .063				1% to 100 kG					
SAR— -1808	565	8" ± .125									
SAR— -1818	590	18" ± .125									
SAR— -1836	620	36" ± .25									
SAB— -1802	190	2" ± .063				1% to 10 kG	1x blue			±.09 Gauss /°C	—.04% /°C
SAB— -1808	220	8" ± .125									
SAB— -1818	240	18" ± .125									
SAB— -1836	275	36" ± .25									
SAG— -1802	255	2" ± .063				2% to 30 kG					
SAG— -1808	275	8" ± .125									
SAG— -1818	285	18" ± .125									
SAG— -1836	330	36" ± .25									
HAK— -2502	385	2" ± .063	.250" ±.005			.25% to 10 kG	10x red			±.13 Gauss /°C	±.005% /°C
HAK— -2508	400	8" ± .125									
HAK— -2518	425	18" ± .125									
HAK— -2536	460	36" ± .25									
HAN— -2502	480	2" ± .063				.5% to 30 kG					
HAN— -2508	495	8" ± .125									
HAN— -2518	520	18" ± .125									
HAN— -2536	550	36" ± .25									
HAR— -2502	570	2" ± .063				1% to 100 kG					
HAR— -2508	590	8" ± .125									
HAR— -2518	605	18" ± .125									
HAR— -2536	645	36" ± .25									
HAB— -2502	220	2" ± .063				1% to 10 kG	1x blue			±.09 Gauss /°C	—.04% /°C
HAB— -2508	235	8" ± .125									
HAB— -2518	255	18" ± .125									
HAB— -2536	285	36" ± .25									
HAG— -2502	275	2" ± .063				2% to 30 kG					
HAG— -2508	285	8" ± .125									
HAG— -2518	310	18" ± .125									
HAG— -2536	340	36" ± .25									
CAP— -2548	obsolete	48" ± .25		.025" ±.005	Glass Epoxy	1% to 30 kG	10x red		—269°C to +75°C	±.013 Gauss /°C	±.01% /°C
CAP— -2560	900	60" ± .5				2% to 100 kG					
CAU— -2548	obsolete	48" ± .25									
CAU— -2560	990	60" ± .5									

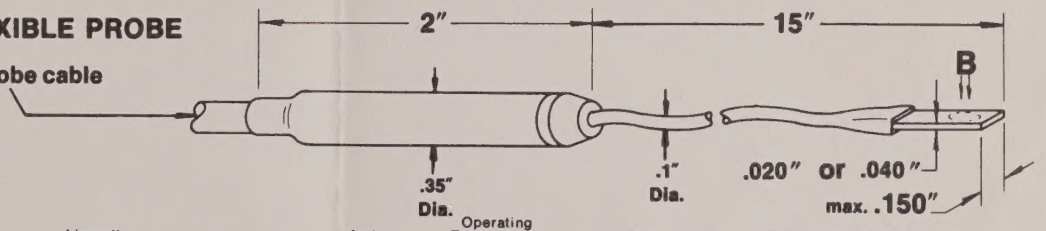
TRANSVERSE PROBE



Includes 5 foot probe cable

Model	Price	A	H	C	D	E	F	G	Stem Material	Linearity % of Reading	Sensitivity	Active Area	Operating Temperature Range	Temperature Stability (max.) Zero	Temperature Stability (max.) Calibrate
STB— -0402	$180	2"±.063	.150" ±.004	.040" +.000 −.004	.145" ±.063	Not Applicable	Not Applicable	Not Applicable	Rigid Glass Epoxy	1% to 10 kG	1x blue	.070" dia. nom.	0°C to +75°C	±.09 Gauss /°C	−.04 %/°C
STB— -0404	190	4"±.063								2% to 30 kG					
STG— -0402	220	2"±.063								.1% to 10 kG	10x red	.040" dia. nom.		±.13 Gauss /°C	±.005 %/°C
STG— -0404	225	4"±.063								.25% to 30 kG					
STJ— -0402	330	2"±.063								1% to 100 kG					
STJ— -0404	340	4"±.063							Aluminum	1% to 10 kG	1x blue	.070" dia. nom.		±.09 Gauss /°C	−.04 %/°C
STL— -0402	425	2"±.063								2% to 30 kG					
STL— -0404	435	4"±.063								.1% to 10 kG	10x red	.040" dia. nom.		±.13 Gauss /°C	±.005 %/°C
STR— -0402	520	2"±.063								.25% to 30 kG					
STR— -0404	525	4"±.063								1% to 100 kG					
HTB— -0608	195	8"±.125	.180" ±.003	.060" +.000 −.004						1% to 10 kG	1x blue	.070" dia. nom.		±.09 Gauss /°C	−.04 %/°C
HTB— -0618	220	18"±.125								2% to 30 kG					
HTG— -0608	240	8"±.125								.1% to 10 kG	10x red	.040" dia. nom.		±.13 Gauss /°C	±.005 %/°C
HTG— -0618	255	18"±.125								.25% to 30 kG					
HTJ— -0608	355	8"±.125								1% to 100 kG					
HTJ— -0618	375	18"±.125							Stainless Steel	1% to 30 kG			−269°C to +75°C		±.01 %/°C
HTL— -0608	440	8"±.125								2% to 100 kG					
HTL— -0618	460	18"±.125													
HTR— -0608	535	8"±.125													
HTR— -0618	550	18"±.125													
CTP— -3248	OBS	48"±.25	.312" ±.005 dia.	Not Appli-cable	.320" ±.063										
CTP— -3260	900	60"±.5													
CTU— -3248	OBS	48"±.25													
CTU— -3260	990	60"±.5													
STB— -0204	195	4" ±.063	.155" ±.005	.040" +.002 −.009	.130" ±.008	.375" ±.063	.130" ±.003	.020" ±.003	Semi-rigid	1% to 10 kG	1x blue	.070" dia. nom.	0°C to +75°C	±.09 Gauss/°C	−.04 %/°C
STG— -0204	240									2% to 30 kG					
STJ— -0204	355									.1% to 10 kG	10x red	.040 dia. nom.		±.13 Gauss/°C	±.005 %/°C
STL— -0204	440									.25% to 30 kG					
STR— -0204	535									1% to 100 kG					
STE— -0104	460				.055" ±.005	.312" ±.031	.080" ±.003	.015" +.000−.003		2% to 10 kG	1x blue			±.15 Gauss/°C	−.08%/°C
STI— -0004	695				.050" ±.005	.375" ±.063	.135" ±.005	.010" +.000−.003		3% to 10 kG		.030" dia. nom.	0°C to +50°C	±.20 Gauss/°C	−.10%/°C

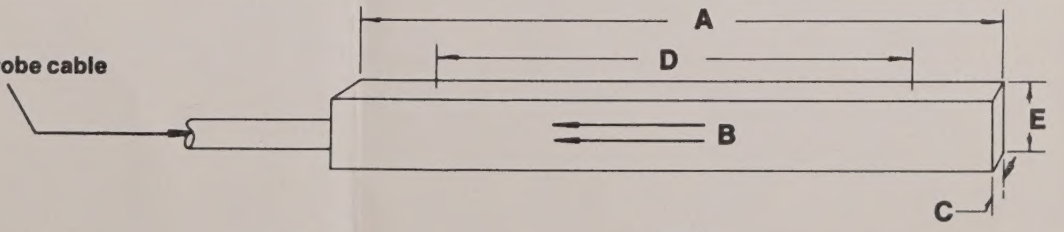
TRANSVERSE FLEXIBLE PROBE



Includes 5 foot probe cable

Model	Price	Linearity % of Reading	Sensitivity	Active Area	Operating Temperature Range	Stem Material	Temperature Stability (max.) Zero	Temperature Stability (max.) Calibrate
FTB— -0415	$225	1% to 10 kG	1x blue	.070" dia. nom.	0°C to +75°C	Flexible Stem Encapsulated Device	±.09 Gauss /°C	−.04% /°C
FTG— -0415	265	2% to 30 kG						
FTJ— -0415	380	.1% to 10 kG	10x red	.040" dia. nom.			±.13 Gauss /°C	±.005% /°C
FTL— -0415	470	.25% to 30 kG						
FTR— -0415	555	1% to 100 kG						
FTB— -0215	240	1% to 10 kG	1x blue	.070" dia. nom.		Flexible Stem Exposed Device	±.09 Gauss /°C	−.04% /°C
FTG— -0215	280	2% to 30 kG						
FTJ— -0215	395	.1% to 10 kG	10x red	.040" dia. nom.			±.13 Gauss /°C	±.005% /°C
FTL— -0215	490	.25% to 30 kG						
FTR— -0215	580	1% to 100 kG						

MAGNAPROBE



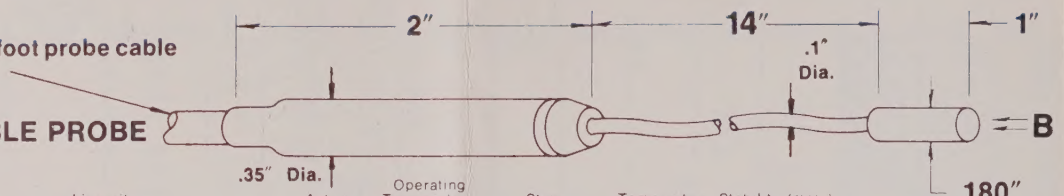
Includes 5 foot probe cable

Model	Price	A	E	C	D	Linearity % of Reading	Sensitivity	Active Area	Operating Temperature Range	Temperature Stability (max.) Zero	Temperature Stability (max.) Calibrate
MOW— -2506	$425	9"±.010	.5"±.015	.25"±.010	6"	2.5% to 2 G	.01x	6" x .25" nom.	0°C to +75°C	±.001 G/°C	−.05%/°C

THIRD GENERATION

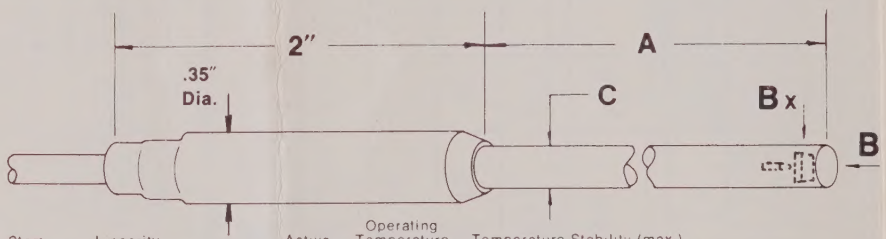
GAUSSMETER PROBES

AXIAL FLEXIBLE PROBE



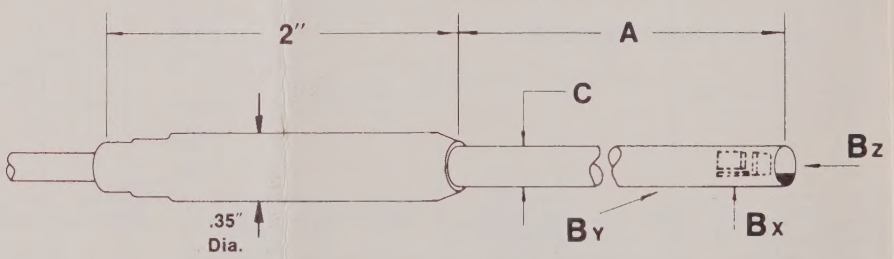
Model	Price	Linearity % of Reading	Sensitivity	Active Area	Operating Temperature Range	Stem Material	Temperature Stability (max.) Zero	Temperature Stability (max.) Calibrate
FAB -0915	$520	1% to 10 kG	1x blue	.030 dia. nom.	0°C to +75°C	Flexible Stem	±.13 Gauss/°C	—.08%/°C
FAB -1815	265					Flexible Stem Aluminum Tip .180″ x 1″	±.09 Gauss /°C	—.04% /°C
FAG -1815	300	2% to 30 kG						
FAK -1815	415	25% to 10 kG	10x red				±.13 Gauss /°C	—.005% /°C
FAN -1815	505	.5% to 30 kG						
FAR -1815	595	1% to 100 kG						

TWO AXIS PROBE



Model	Price	A	C	Stem Material	Linearity % of Reading	Sensitivity	Active Area	Operating Temperature Range	Temperature Stability (max.) Zero	Temperature Stability (max.) Calibrate
YOB -1802	$790	2″±.063	.180″ ±.002 —.004	Aluminum	1% to 10 kG	1x blue	.020 dia. Nom.	0°C to +75°C	±.1 Gauss /°C	—.04% /°C
YOB -1808	805	8″±.125								
YOB -1818	825	18″±.125								
YOB -1836	865	36″±.25								

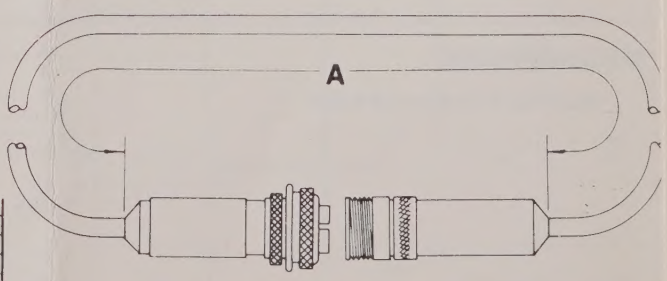
THREE AXIS PROBE



Model	Price	A	C	Stem Material	Linearity % of Reading	Sensitivity	Active Area	Operating Temperature Range	Temperature Stability (max.) Zero	Temperature Stability (max.) Calibrate
ZOB -3202	$1320	2″±.063	.312″ ±.005	Aluminum	1% to 10 kG	1x blue	060″ dia. nom.	0°C to +75°C	±.10 Gauss /°C	—.04% /°C
ZOB -3208	1350	8″±.125								
ZOB -3218	1355	18″±.125								
ZOB -3236	1355	36″±.25								

EXTENSION CABLES

● **The calibrated extension cables are trimmed at the factory to achieve zero error with a specific probe. The cable will be in calibration with that probe only. Other probes, even of the same model number, will not necessarily be in calibration with the cable.**

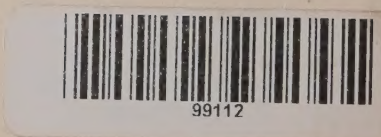


Model	Price	A	Error
XOVO -0010	$ 50	10′±2″	1%
XOQ— -0010	90	10′±2″	0.0 ●
XOVO -0025	80	25′±2″	2%
XOQ— -0025	110	25′±2″	0.0 ●
XOVO -0050	110	50′±2″	3%
XOQ— -0050	145	50′±2″	0.0 ●
XOVO -0100	190	100′±2″	5%
XOQ— -0100	210	100′±2″	0.0 ●

Specifications subject to change without notice.

Printed in U.S.A.

F.W.BELL
Subsidiary, Magnetics & Electronics, Inc.
6120 Hanging Moss I
Orlando, Florida 328
Phone: 305-678-6
TWX: 810-853-3


99112